Arguments/Remarks

Upon entry of this amendment, claims 1 and 5 will be amended, whereby claims 1-7 will remain pending. Claims 1 and 5 are independent claims.

The amendment to claims 1 and 6 is in conformance with the disclosure in the originally filed application, and does not include new matter. For example, the Examiner's attention is directed to page 11, lines 12-16 and page 16, line 3-7. Moreover, the specification is amended herein to include the claims explicitly therein.

Reconsideration and allowance of the application are respectfully requested.

Submission Of Supplemental Information Disclosure Statement

Applicants are submitting on even date herewith a Supplemental Information Disclosure Statement. The Examiner is respectfully requested to indicate consideration of this Supplemental Information Disclosure Statement by initialing the Form PTO-1449 submitted therewith, and forwarding an initialed copy of the form with the next communication from the Patent and Trademark Office.

Response To Rejections Based Upon Prior Art

The following rejections are set forth in the Office Action:

(1) Claims 1-3 and 5-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nobori et al., U.S. Patent No. 5,616,024, in view of Arena et al., U.S. Patent No. 5,635,093 and Mahawili, U.S. Patent No. 5,294,778 or Carman et al., U.S., Patent No. 5,294,778.

(2) Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nobori et al. and Arena et al. and Mahawili or Carman et al, and further in view of Aoki et al., U.S. Patent No. 6,121,579.

In these grounds of rejection, it is asserted that in view of Arena it would have been obvious to adapt Nobori with the temperature sensing means including the processing and comparison means to store and calculate by comparing the detected values with the reference values to subsequently control the heating elements. Moreover, it is asserted that in view of Mahawili and Carman it would have been obvious to adapt Nobori with the outer heating circuit having the capability to makes its temperature equal to or higher than the inner portion to maintain the desired heating temperature across the heater substrate.

Moreover, with respect to Aoki, the rejection contends that in view of Aoki it would have been obvious to adapt Nobori with the thermoviewer in place of the thermocouple as the temperature sensing element to effectively measure the temperature across the heater plate.

In response to the rejections set forth in the Office Action, Applicants respectfully submit that the present invention as recited in independent claim 1 is directed to a ceramic heater for heating a wafer comprising a ceramic substrate; a resistor heating body on a surface of said ceramic substrate or inside said ceramic substrate; a temperature measuring unit embedded in bottomed-holes formed on the surface opposite to a heating face of the ceramic substrate for measuring a temperature of the ceramic substrate; a control unit feeding power to the resistor heating body; a memory unit storing temperature data measured by the temperature measuring unit; a calculation unit calculating power to be fed to the resistor heating body from the

temperature data; and the resistor heating body comprising two or more circuits capable of controlling the temperature independently, in which a temperature of a circuit located at an outer peripheral portion among the two or more circuits is controlled so as to be made higher than a temperature of a circuit located at an inner peripheral portion, and a wafer is heated while the wafer is separated apart from a heating face of the ceramic substrate.

Moreover, Applicants' invention as recited in independent claim 5 is directed to a method of controlling a temperature of a substrate in a ceramic heater for heating a wafer comprising a ceramic substrate; a resistor heating body on a surface or inside the ceramic substrate; a temperature measuring unit embedded in bottomed-holes formed on the surface opposite to a heating face of said ceramic substrate for measuring a temperature of the ceramic substrate; a control unit feeding power to the resistor heating body; a memory unit storing temperature data measured by the temperature measuring unit; a calculation unit calculating power to be fed to the resistor heating body from the temperature data; and the resistor heating body comprising two or more circuits capable of controlling the temperature independently; the process comprising controlling a temperature of a circuit located at an outer peripheral portion among the two or more circuits to a temperature higher than a temperature of a circuit located at an inner peripheral portion and heating a wafer while the wafer is separated apart from a heating face of the ceramic substrate.

Thus, amongst other features, Applicants' invention relates to a ceramic heater for heating a wafer, wherein the resistor heating body comprises <u>two or more circuits at least at an inner peripheral portion and an outer peripheral portion capable of controlling the temperature</u>

independently, in which a temperature of a circuit located at an outer peripheral portion among the two or more circuits is controlled by a plurality of temperature measuring units so as to made higher to a temperature of a circuit located at an inner peripheral portion, and a wafer is heated while the wafer is separated apart from a heating face of the ceramic substrate.

In the ceramic heater of the present invention, the outer peripheral side of the wafer is liable to be easily influenced by an atmosphere of an exterior and the temperature is apt to drop down. For this end, the outer peripheral temperature of the ceramic substrate is made higher to prevent the drop of the outer peripheral temperature of the wafer, whereby the wafer is uniformly heated.

In order to make a temperature of a ceramic substrate constant, the temperature is controlled for generating the high amount of heat in a circuit on the side of an outer peripheral portion so as to make temperatures of the heating surface of the ceramic substrate uniform.

At the initial control stage, the drop or rise of the temperature accompanied with the control is caused, so that the wafer is subjected to a temperature change of the ceramic substrate until the temperature of the ceramic substrate becomes uniform. For example, as shown in Fig. 5, the temperature difference between the interior and the exterior of the ceramic substrate is large in the initial control stage. For this end, if the wafer contacts with the ceramic substrate, it is subjected to the temperature change of the ceramic substrate.

In the present invention, the wafer is separated apart from the ceramic substrate, whereby the wafer is hardly subjected to the temperature change. Such a construction and effect are not taught or suggested from the documents utilized in the rejection.

Applicants submit that Nobori does not disclose the division of the heating pattern. For example, the heating body of Nobori is not divided, and even if it is divided, there is no intention of controlling the inner peripheral portion and the outer peripheral portion independently. Hence, it is not possible in Nobori to control a temperature at the outer peripheral portion to the same temperature of the inner peripheral portion.

However, irrespective of whether or not Nobori does disclose independent control as asserted by the Examiner, in Nobori the wafer contacts with the ceramic substrate. Accordingly, in Nobori the wafer contacts with the ceramic substrate, and it is subjected to the temperature change of the ceramic substrate. Since the wafer of Nobori contacts with the ceramic substrate, it is subjected to the temperature change between the interior and the exterior of the ceramic substrate at the initial control stage as shown in Fig. 5.

Moreover, Applicants respectfully submit that the deficiencies of Nobori are not overcome by any of the remaining documents utilized in the rejections of record.

Initially, Applicants once again note that because Nobori designs his ceramic heater with spacing of the coils and convolution configuration as well as sequentially combined heating coils separately powered to provide uniform heating, one having ordinary skill in the art would not have been motivated to modify the disclosure of Nobori and essentially destroy Nobori's structure and improvement over the prior art.

One having ordinary skill in the art would not have been motivated to combine Arena with Nobori. Arena is directed to dividing a heater pattern, but provides zones not having a pattern between patterns. Arena discloses at column 4, lines 25-30, that the length l_n of each

conductor element can be adjusted so as to have a surface distribution corresponding to the heat quantity which it is desired to obtain in a given zone. Moreover, Arena discloses at column 4, lies 3-34 supply means 22 to vary intensities injected into the conductor elements 8, which also has the effect of varying the temperature on the corresponding surface 2 of the bed plate 4. Arena also discloses at column 4, lines 26-29. "so as to have a surface distribution corresponding o the heat quantity which it is wished to obtain in a given zone' and designs for making the heating uniform.

Moreover, it appears that the heating place of Arena comprises a bed or base plate made from a material having good thermal conductivity, and is apparently a metal as compared to Applicants' recited ceramic substrate.

The substrate in Arena is placed on the surface of the heating plate and the wafer is contacted with the ceramic substrate, so that the wafer is subjected to the temperature change between the interior and the exterior of the ceramic substrate at the initial control stage as shown in Fig. 5 of the present application. Therefore, there cannot be obtained the same effects of the present invention.

Accordingly, any combination of Arena and Nobori would not arrive at Applicants' disclosed and claimed invention.

Aoki discloses a technique relating to lamp heat, and its technical assumption is different from the present invention which electrically controls the temperature by a heating body. Moreover, as previously noted by Applicants, Aoki is merely utilized in the rejection in an attempt to establish the obviousness of a thermoviewer as an alternative temperature sensing

element. Applicants respectfully submit that there is no motivation following the disclosure of Aoki and/or the other documents utilized in the rejection to make the asserted substitution of elements. However, whether or not it would have been obvious to make the substitution asserted in the rejection, Aoki does not overcome the deficiencies of the combination of documents.

Mahawili discloses that the heater 22 is covered with a shroud 26 such as quartz or the like and the wafer is directly placed on the shroud 26 (column 4, lines 64-65). For this end, the wafer is subjected to the temperature change between the inside and the outside of the substrate at the initial control stage as discussed above. Accordingly, any combination of Mahawill with the documents utilized in the rejections would not arrive at Applicants' disclosed and claimed invention.

Carman is directed to a CVD platen heater system utilizing concentric heating elements. Carman discloses that the platen heating system includes a support platen 52 and a plurality of heaters 1, 14 and 16; however, it does not appear that Carman clearly discloses how the elements are associated with respect to each other. In this regard, it does not appear that Carman teaches or suggests any heating body on a surface of a ceramic substrate or inside a ceramic substrate as in Applicants' disclosed and claimed invention. Accordingly, any combination of Carman with Nobori and/or Arena and/or Aoki and/or Mahawill would not arrive at Applicants' disclosed and claimed invention.

Still further, Carman does not clearly show what material a heater uses, and there is a gap between a support platen 52 and a heater, and a heating body is not formed on the surface of the ceramic substrate or inside the ceramic substrate.

Further, according to column 3, line 60 to column 4, line 13 of Carman, there is described that, "Referring now to Fig. 3, main spiral heater 12, heats heat zone 32 while edge loss heaters 14 and 16 heat zones 34 and 36, respectively. Referring now to Fig 5, since all three individual heaters 12, 14 and 16 are individually powered and controlled, the temperatures of each individual heat zones 32, 34 and 36, may adjusted to provide either a flat uniform temperature profile across support platen 52 such as shown generally at graph 82, or the temperature of support platen 52 may be adjusted slightly greater at either inner heat zone 34 or outer heat zone 36 by simply turning up the power on inner edge loss heater 14 or outer edge loss heater 16 as shown generally at graphs 84 and 86, respectively. Since support platen 52 is slowly rotating, it can be seen that a uniform temperature profile is maintained across support platen 52 in the circumferential direction while the temperature profile in the radical direction can be tilted slightly, that is raised slightly in the center or at the periphery of the support platen 52, as illustrated in graphs of 84 and 86. A typical range of temperature elevations for tilt is 1° - 30°." (Emphasis added.)

In short, Carman controls the heater independently, but the support platen 52 revolves apart from the heater, so that the support platen is provided with temperature inclination in the diameter direction.

Further, as Carman revolves the heater separated from the ceramic substrate, it is necessary to carry out temperature control on the assumption of revolution, and Carman is entirely different from the present invention which provides a heating body on the surface of a ceramic substrate or inside the ceramic substrate.

Accordingly, while one having ordinary skill in the art would not have combined the diverse disclosures of the documents utilized in the rejections. However, even if the disclosures were combined, the presently claimed invention would not be present.

In view of the above, the rejections of record should be withdrawn, and each of the pending claims indicated to be allowable over the prior art of record.

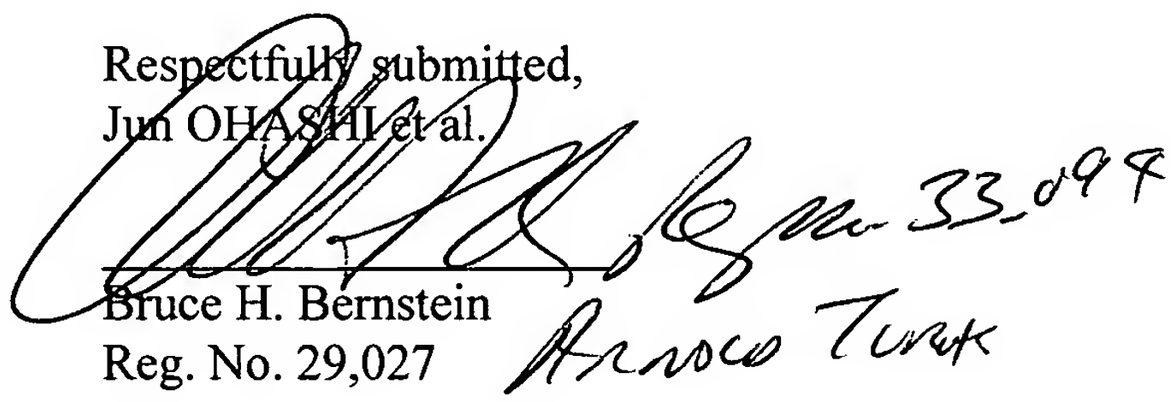
CONCLUSION

In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejections of record, and allow each of the pending claims.

Applicants therefore respectfully request that an early indication of allowance of the application be indicated by the mailing of the Notices of Allowance and Allowability.

Any comments or questions concerning this application can be directed to the undersigned at the telephone number given below.

Respectfully submitted,
Jun OHASHI et al.



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